



# STGW30NB60HD

N-CHANNEL 30A - 600V TO-247  
PowerMESH™ IGBT

TYPE	V <sub>CES</sub>	V <sub>CE(sat)</sub>	I <sub>C</sub>
STGW30NB60HD	600 V	< 2.8 V	30 A

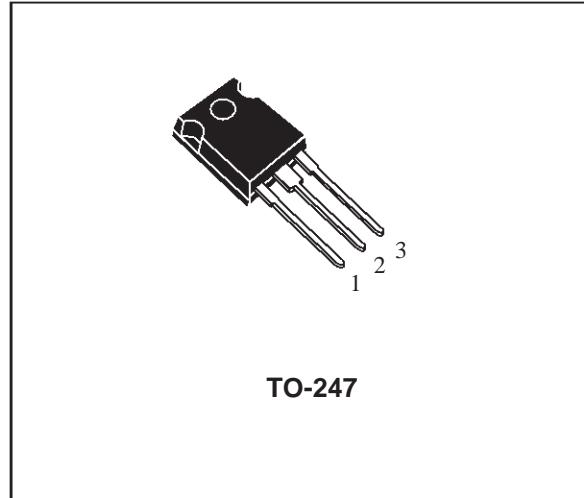
- HIGH INPUT IMPEDANCE (VOLTAGE DRIVEN)
- LOW ON-VOLTAGE DROP (V<sub>CESAT</sub>)
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- VERY HIGH FREQUENCY OPERATION
- OFF LOSSES INCLUDE TAIL CURRENT
- CO-PACKAGE WITH TURBOSWITCH™ ANTIPARALLEL DIODE

## DESCRIPTION

Using the latest high voltage technology based on a patented strip layout, STMicroelectronics has designed an advanced family of IGBTs, the PowerMESH™ IGBTs, with outstanding performances. The suffix "H" identifies a family optimized to achieve very low switching times for high frequency applications (<120kHz).

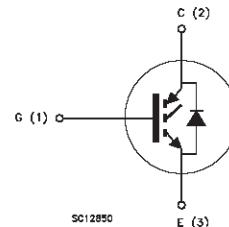
## APPLICATIONS

- HIGH FREQUENCY MOTOR CONTROLS
- WELDING EQUIPMENTS
- SMPS AND PFC IN BOTH HARD SWITCH AND RESONANT TOPOLOGIES



TO-247

## INTERNAL SCHEMATIC DIAGRAM



## ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V <sub>CES</sub>	Collector-Emitter Voltage (V <sub>GS</sub> = 0)	600	V
V <sub>ECD</sub>	Emitter-Collector Voltage	20	V
V <sub>GE</sub>	Gate-Emitter Voltage	± 20	V
I <sub>C</sub>	Collector Current (continuous) at T <sub>c</sub> = 25 °C	60	A
I <sub>C</sub>	Collector Current (continuous) at T <sub>c</sub> = 100 °C	30	A
I <sub>CM(•)</sub>	Collector Current (pulsed)	240	A
P <sub>tot</sub>	Total Dissipation at T <sub>c</sub> = 25 °C	190	W
	Derating Factor	1.52	W/°C
T <sub>stg</sub>	Storage Temperature	-65 to 150	°C
T <sub>j</sub>	Max. Operating Junction Temperature	150	°C

(•) Pulse width limited by safe operating area

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## THERMAL DATA

R <sub>thj-case</sub>	Thermal Resistance Junction-case	Max	0.66	°C/W
R <sub>thj-amb</sub>	Thermal Resistance Junction-ambient	Max	30	°C/W
R <sub>thc-h</sub>	Thermal Resistance Case-heatsink	Typ	0.1	°C/W

## ELECTRICAL CHARACTERISTICS ( $T_j = 25^\circ\text{C}$ unless otherwise specified)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V <sub>BR(CES)</sub>	Collector-Emitter Breakdown Voltage	I <sub>C</sub> = 250 μA V <sub>GE</sub> = 0	600			V
I <sub>CES</sub>	Collector cut-off (V <sub>GE</sub> = 0)	V <sub>CE</sub> = Max Rating T <sub>j</sub> = 25 °C V <sub>CE</sub> = Max Rating T <sub>j</sub> = 125 °C			250 2000	μA μA
I <sub>GES</sub>	Gate-Emitter Leakage Current (V <sub>CE</sub> = 0)	V <sub>GE</sub> = ± 20 V V <sub>CE</sub> = 0			± 100	nA

## ON (\*)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V <sub>GE(th)</sub>	Gate Threshold Voltage	V <sub>CE</sub> = V <sub>GE</sub> I <sub>C</sub> = 250 μA	3		5	V
V <sub>CE(SAT)</sub>	Collector-Emitter Saturation Voltage	V <sub>GE</sub> = 15 V I <sub>C</sub> = 30 A V <sub>GE</sub> = 15 V I <sub>C</sub> = 30 A T <sub>j</sub> = 125 °C		2.2 1.8	2.8	V V

## DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g <sub>fs</sub>	Forward Transconductance	V <sub>CE</sub> = 25 V I <sub>C</sub> = 30 A		20		S
C <sub>ies</sub> C <sub>oes</sub> C <sub>res</sub>	Input Capacitance Output Capacitance Reverse Transfer Capacitance	V <sub>CE</sub> = 25 V f = 1 MHz V <sub>GE</sub> = 0		2300 250 60		pF pF pF
Q <sub>G</sub> Q <sub>GE</sub> Q <sub>GC</sub>	Total Gate Charge Gate-Emitter Charge Gate-Collector Charge	V <sub>CE</sub> = 480 V I <sub>C</sub> = 30 A V <sub>GE</sub> = 15 V		150 15 72		nC nC nC
I <sub>CL</sub>	Latching Current	V <sub>clamp</sub> = 480 V R <sub>G</sub> = 10 Ω T <sub>j</sub> = 150 °C	120			A

## SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
t <sub>d(on)</sub> t <sub>r</sub>	Delay Time Rise Time	V <sub>CC</sub> = 480 V I <sub>C</sub> = 30 A V <sub>GE</sub> = 15 V R <sub>G</sub> = 10 Ω		15 35		ns ns
(di/dt) <sub>on</sub> E <sub>on</sub>	Turn-on Current Slope Turn-on Switching Losses	V <sub>CC</sub> = 480 V I <sub>C</sub> = 30 A R <sub>G</sub> = 10 Ω V <sub>GE</sub> = 15 V T <sub>j</sub> = 125 °C		1000 1000		A/μs μJ

**ELECTRICAL CHARACTERISTICS (continued)**

## SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_c$	Cross-Over Time	$V_{CC} = 480 \text{ V}$		150		ns
$t_r(V_{off})$	Off Voltage Rise Time	$I_C = 30 \text{ A}$		40		ns
$t_d(\text{off})$	Delay Time	$R_{GE} = 10 \Omega$		210		ns
$t_f$	Fall Time	$V_{GE} = 15 \text{ V}$		90		ns
$E_{off}^{(**)}$	Turn-off Switching Loss			1.10		mJ
$E_{ts}(\odot)$	Total Switching Loss			2.0		mJ
$t_c$	Cross-Over Time	$V_{CC} = 480 \text{ V}$		250		ns
$t_r(V_{off})$	Off Voltage Rise Time	$I_C = 30 \text{ A}$		70		ns
$t_d(\text{off})$	Delay Time	$R_{GE} = 10 \Omega$		250		ns
$t_f$	Fall Time	$T_j = 125 \text{ }^\circ\text{C}$		160		ns
$E_{off}^{(**)}$	Turn-off Switching Loss			1.6		mJ
$E_{ts}(\odot)$	Total Switching Loss			2.65		mJ

**COLLECTOR-EMITTER DIODE**

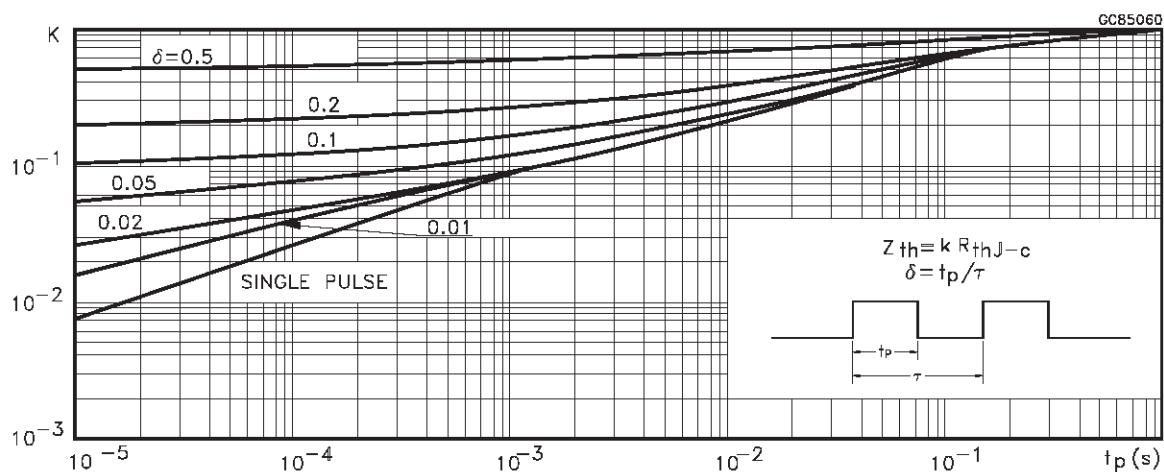
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$I_f$	Forward Current				30	A
$I_{fm}$	Forward Current pulsed				240	A
$V_f$	Forward On-Voltage	$I_f = 30 \text{ A}$ $I_f = 30 \text{ A}$		1.7 1.55	2.0	V V
$t_{rr}$ $Q_{rr}$ $I_{rrm}$	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	$I_f = 30 \text{ A}$ $dI/dt = 100 \text{ A}/\mu\text{s}$	$V_R = 100 \text{ V}$ $T_j = 125 \text{ }^\circ\text{C}$		116 406 7	nS nC A

(•) Pulse width limited by max. junction temperature

(◦) Include recovery losses on the STTA2006 freewheeling diode

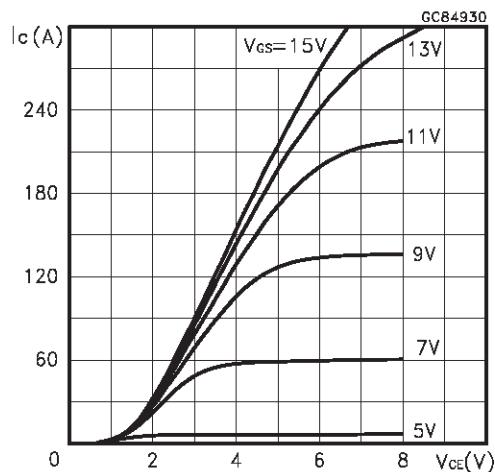
(\*) Pulsed: Pulse duration = 300 µs, duty cycle 1.5 %

(\*\*) Losses Include Also The Tail (Jedec Standardization)

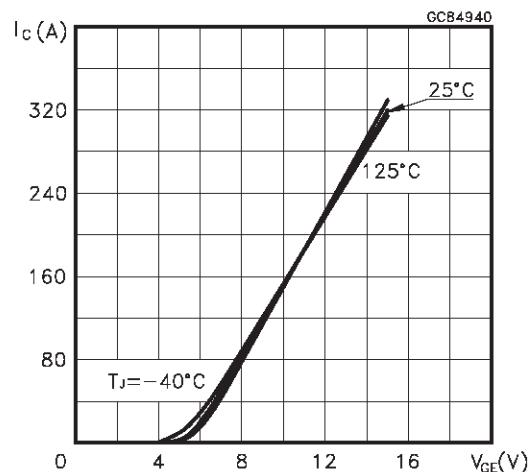
**Thermal Impedance**

# STGW30NB60HD

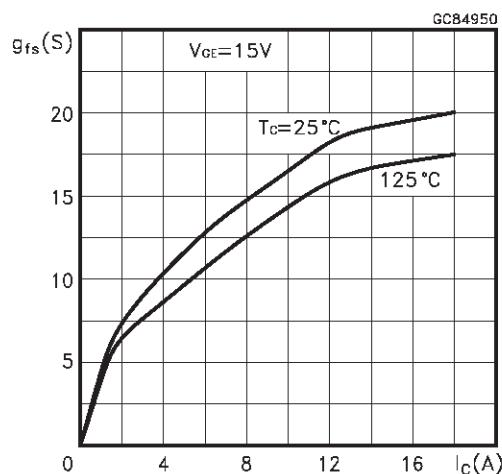
## Output Characteristics



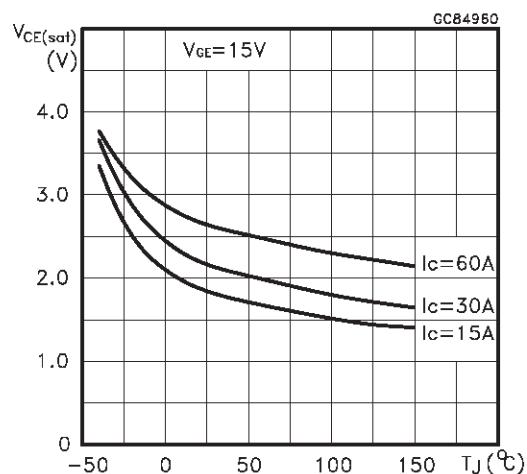
## Transfer Characteristics



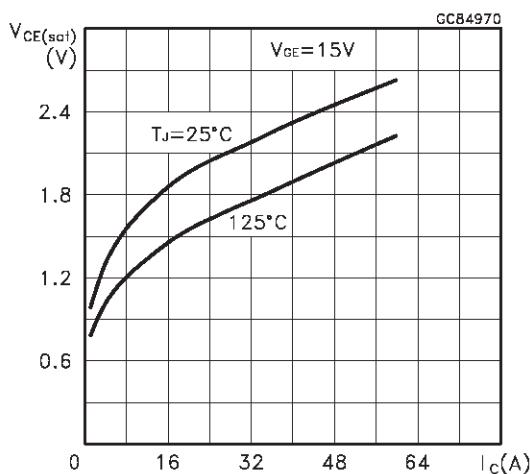
## Transconductance



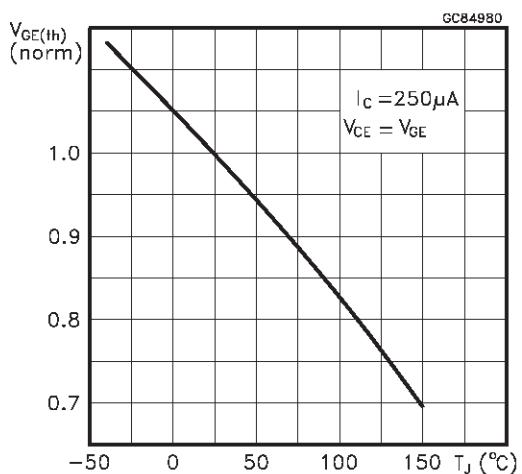
## Collector-Emitter On Voltage vs Temperature



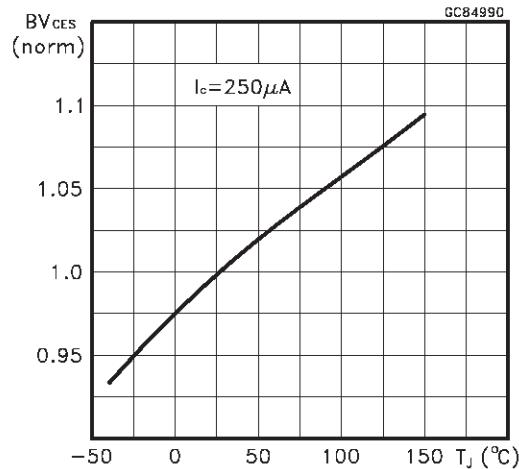
## Collector-Emitter On Voltage vs Collector Current



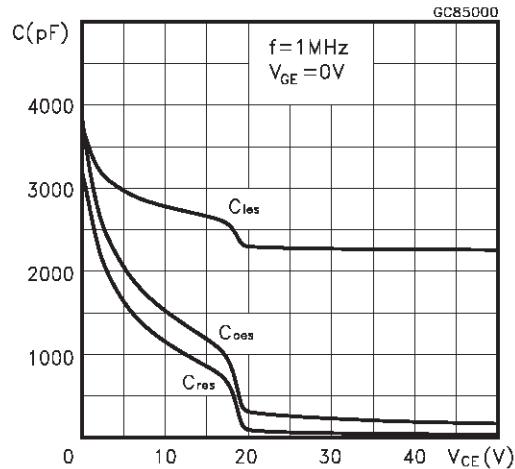
## Gate Threshold vs Temperature



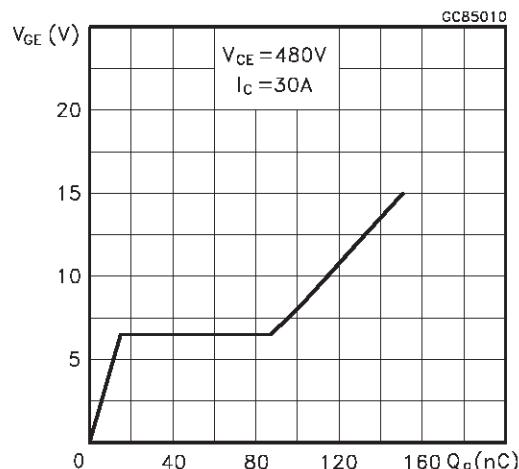
Normalized Breakdown Voltage vs Temperature



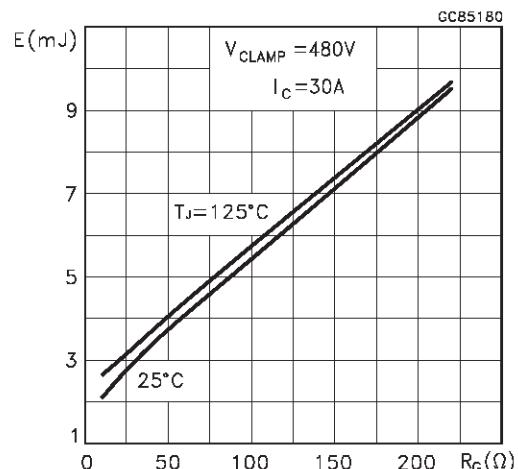
Capacitance Variations



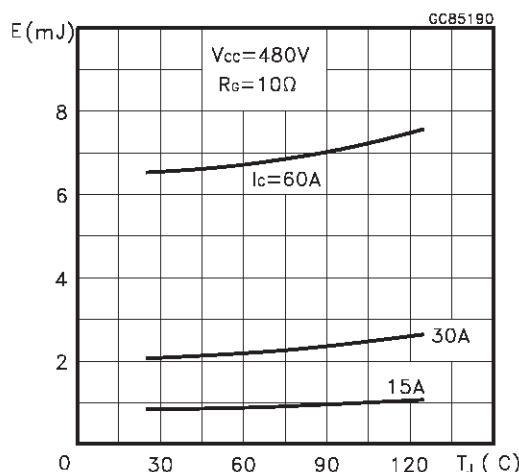
Gate Charge vs Gate-Emitter Voltage



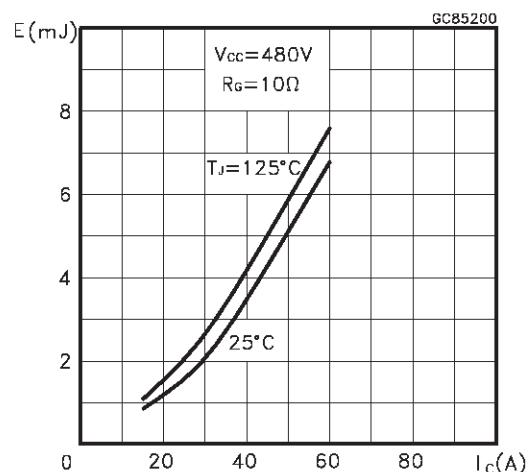
Total Switching Losses vs Gate Resistance



Total Switching Losses vs Temperature



Total Switching Losses vs Collector Current



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## Switching Off Safe Operating Area

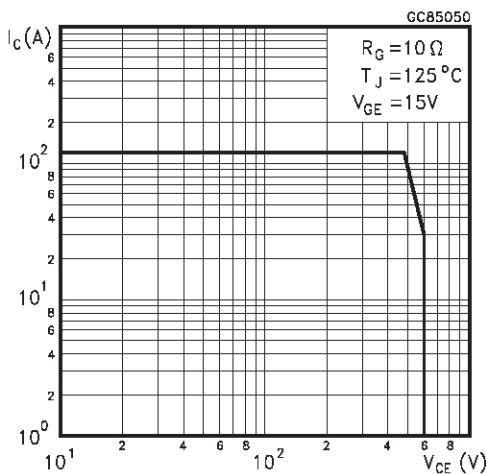


Fig. 1: Gate Charge test Circuit

## Diode Forward Voltage

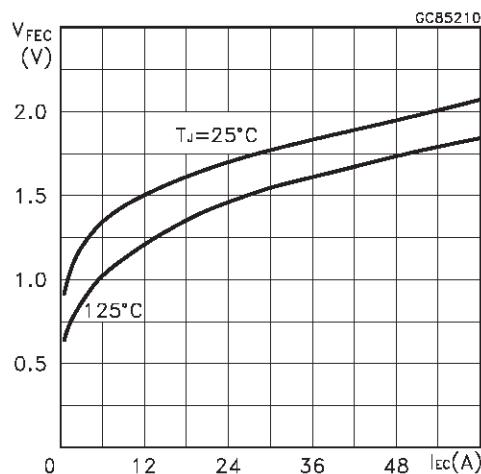


Fig. 2: Test Circuit For Inductive Load Switching

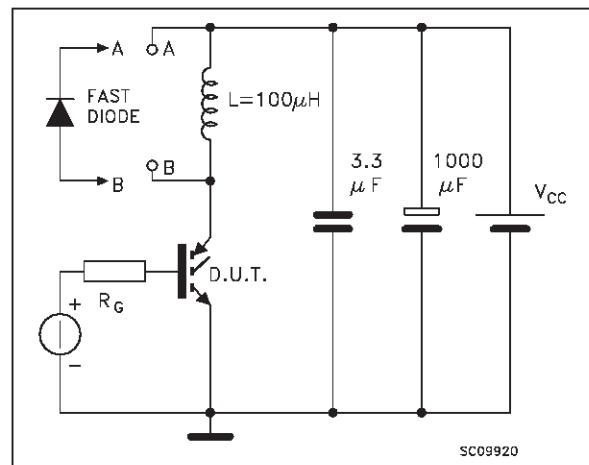
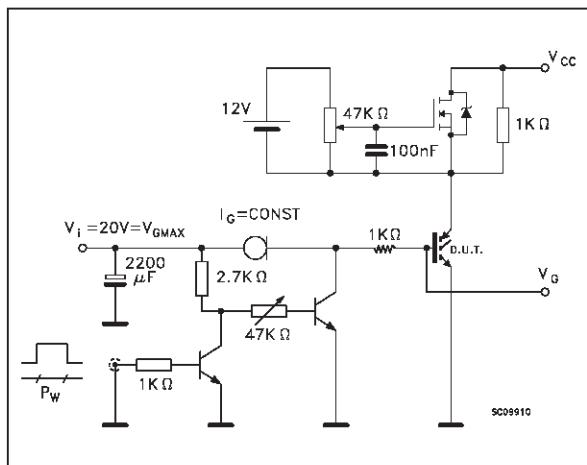
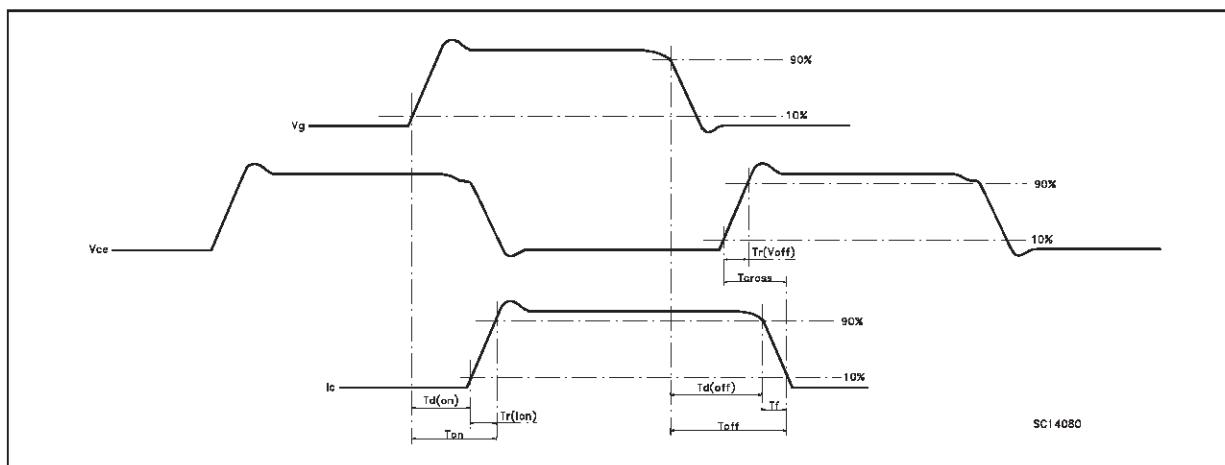
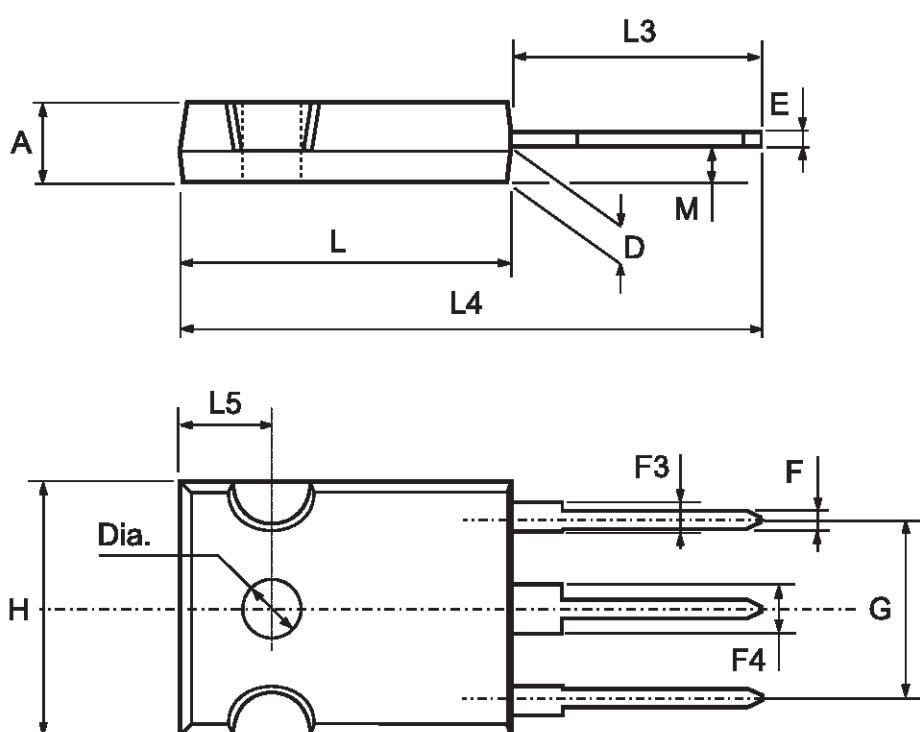


Fig. 3: Switching Waveforms



## TO-247 MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.7		5.3	0.185		0.209
D	2.2		2.6	0.087		0.102
E	0.4		0.8	0.016		0.031
F	1		1.4	0.039		0.055
F3	2		2.4	0.079		0.094
F4	3		3.4	0.118		0.134
G		10.9			0.429	
H	15.3		15.9	0.602		0.626
L	19.7		20.3	0.776		0.779
L3	14.2		14.8	0.559		0.582
L4		34.6			1.362	
L5		5.5			0.217	
M	2		3	0.079		0.118



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